

Arpan Gujarati

Postdoctoral Researcher at MPI-SWS

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Research Interests

Real-time systems, distributed systems, fault tolerance, reliability analysis, and scheduling

Education

- 2014–2020 **Ph.D. in Computer Science with Highest Distinction (*Summa Cum Laude*)**
Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken/Kaiserslautern, Germany
and Technical University of Kaiserslautern (TU-KL), Kaiserslautern, Germany
Advisor: Björn B. Brandenburg (head of the Real-Time Systems Group at MPI-SWS)
Thesis: *Towards "Ultra-Reliable" CPS: Reliability Analysis of Distributed Real-Time Systems*
(submitted in January 2020, defended in October 2020)
- 2012–2014 **Preparatory Phase (Graduate Coursework)**
Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken/Kaiserslautern, Germany
and Saarland University (UdS), Saarbrücken, Germany
- 2007–2011 **B.E. (Hons.) in Computer Science**
Birla Institute of Technology and Science (BITS), Pilani, India

Work Experience

- 2021 **Research Associate (expected to start in January 2021)**
Computer Science Department, University of British Columbia (UBC), Vancouver, Canada
- 2020 **Postdoctoral Researcher**
Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken/Kaiserslautern, Germany
Advisor: Jonathan Mace
Focus areas: Building efficient systems for deep neural network inference serving in cloud
- 2012–2019 **Graduate Research Assistant**
Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken/Kaiserslautern, Germany
Advisor: Björn B. Brandenburg
Focus areas: Scheduling and fault-tolerance in real-time systems
- 2015 **Research Intern (three months)**
Microsoft Research, Redmond, WA, USA
Mentors: Kathryn S. McKinley, Sameh Elnikety, Yuxiong He
Focus areas: Distributed autoscaling of machine learning inference services
- 2011–2012 **Software Development Engineer**
Cloud Networking Group, Citrix R&D, Bengaluru, India
Manager: Sanjay Gupta
Focus areas: Management Service VM for the Xen Server
- 2011 **Software Development Intern**
Visual and Parallel Computing Group, Intel, Bengaluru, India
Team: Display Features and Miniport
Focus areas: Prototype code optimizations for kernel-mode graphics drivers

Honors and Awards

- OSDI'20 **Distinguished Artifact Award**
14th USENIX Symposium on Operating Systems Design and Implementation
- RTAS'20 **Distinguished Paper Award**
26th IEEE Real-Time and Embedded Technology and Applications Symposium

- ECRTS'18 **Best Presentation Award**
30th Euromicro Conference on Real-Time Systems
- Middleware'17 **Best Student Paper Award**
18th ACM/IFIP/USENIX International Middleware Conference
- HLF'14 **Young Researcher**
2nd Heidelberg Laureate Forum
- ECRTS'13 **Outstanding Paper Award**
25th Euromicro Conference on Real-Time Systems

Invited Talks

- 2020 **Towards “Ultra-Reliable” CPS: Reliability Analysis of Distributed Real-Time Systems**
George Mason University. Host: Hakan Aydin
Washington University at St. Louis. Host: Sanjoy Baruah
Oregon State University. Host: Rakesh Bobba
IMDEA Software Institute. Host: Manuel Hermenegildo
- 2019 **Towards “Ultra-Reliable” CPS: Reliability Analysis of Distributed Real-Time Systems**
George Washington University. Host: Gabriel Parmer
University of Pennsylvania. Host: Linh Thi Xuan Phan

Publications

Conference Publications

- OSDI'20 **Serving DNNs like Clockwork: Performance Predictability from the Bottom Up**
Arpan Gujarati, Reza Karimi, Safya Alzayat, Wei Hao, Antoine Kaufmann, Ymir Vigfusson, and Jonathan Mace
14th USENIX Symposium on Operating Systems Design and Implementation (virtual)
- RTAS'20 **Real-Time Replica Consistency over Ethernet with Reliability Bounds**
Arpan Gujarati, Sergey Bozhko, and Björn B. Brandenburg
26th IEEE Real-Time and Embedded Technology and Applications Symposium (virtual)
- ECRTS'19 **From Iteration to System Failure: Characterizing the FITness of Periodic Weakly-Hard Systems**
Arpan Gujarati, Mitra Nasri, Rupak Majumdar, and Björn B. Brandenburg
31th Euromicro Conference on Real-Time Systems, Stuttgart, Germany
- ECRTS'18 **Quantifying the Resiliency of Fail-Operational Real-Time Networked Control Systems**
Arpan Gujarati, Mitra Nasri, and Björn B. Brandenburg
30th Euromicro Conference on Real-Time Systems, Barcelona, Spain
- EuroSys'18 **Tableau: A High-Throughput and Predictable VM Scheduler for High-Density Workloads**
Manohar Vanga, Arpan Gujarati, and Björn B. Brandenburg
13th European Conference on Computer Systems, Porto, Portugal
- Middleware'17 **Swayam: Distributed Autoscaling to Meet SLAs of Machine Learning Inference Services with Resource Efficiency**
Arpan Gujarati, Sameh Elnikety, Yuxiong He, Kathryn S. McKinley, and Björn B. Brandenburg
18th ACM/IFIP/USENIX International Middleware Conference, Las Vegas, USA
- RTSS'15 **When is CAN the Weakest Link? A Bound on Failures-In-Time in CAN-Based Real-Time Systems**
Arpan Gujarati and Björn B. Brandenburg
36th IEEE Real-Time Systems Symposium, San Antonio, USA
- RTSS'14 **Linux's Processor Affinity API, Refined: Shifting Real-Time Tasks towards Higher Schedulability**
Felipe Cerqueira, Arpan Gujarati, and Björn B. Brandenburg
35th IEEE Real-Time Systems Symposium, Rome, Italy
- ECRTS'13 **Schedulability Analysis of the Linux Push and Pull Scheduler with Arbitrary Processor Affinities**
Arpan Gujarati, Felipe Cerqueira, and Björn B. Brandenburg
25th Euromicro Conference on Real-Time Systems, Paris, France

Journal Publications

- RTS'18 **Correspondence Article: A Correction of the Reduction-Based Schedulability Analysis for APA Scheduling**
Arpan Gujarati, Felipe Cerqueira, Björn B. Brandenburg, and Geoffrey Nelissen
Real-Time Systems, August 2018
- RTS'15 **Multiprocessor Real-Time Scheduling with Arbitrary Processor Affinities: From Practice to Theory**
Arpan Gujarati, Felipe Cerqueira, and Björn B. Brandenburg
Real-Time Systems, Volume 51, Issue 4, pp. 440–483. Springer Verlag, 2015
- Workshop and Work-in-Progress Publications**
- WoSoCER'20 **New Wine in an Old Bottle: N-Version Programming for Machine Learning Components**
Arpan Gujarati, Sathish Gopalakrishnan, and Karthik Pattabiraman,
10th IEEE International Workshop on Software Certification (virtual)
- EMSOFT'19 **Work-in-Progress: Achal: Building Highly Reliable Networked Control Systems**
Malte Appel, Arpan Gujarati, and Björn B. Brandenburg,
15th ACM International Conference on Embedded Software, New York City, USA
- CERTS'18 **Using Schedule-Abstraction Graphs for the Analysis of CAN Message Response Times**
Mitra Nasri, Arpan Gujarati, and Björn B. Brandenburg
3rd Workshop on Security and Dependability of Critical Embedded Real-Time Systems, Luxembourg
- CERTS'17 **Lower-Bounding the MTTF for Systems with (m, k) Constraints and IID Iteration Failure Probabilities**
Arpan Gujarati, Mitra Nasri, and Björn B. Brandenburg
2nd Workshop on Security and Dependability of Critical Embedded Real-Time Systems, Paris, France
- CERTS'17 **A Byzantine Fault-Tolerant Key-Value Store for Safety-Critical Distributed Real-Time Systems**
Malte Appel, Arpan Gujarati, and Björn B. Brandenburg,
2nd Workshop on Security and Dependability of Critical Embedded Real-Time Systems, Paris, France

Professional Activities

Technical Program Committee

- SYSTOR International Systems and Storage Conference (2021)
- ICDCS International Conference on Distributed Computing Systems (2021)
- Middleware International Middleware Conference, Doctoral Symposium (2020)
- ECRTS AE Euromicro Conference on Real-Time Systems, Artifact Evaluation (2019)
- RTAS BP Real-Time and Embedded Technology and Applications Symposium, Brief Presentations (2019)
- RTEST WiP Real-Time and Embedded Systems and Technologies, Work-in-Progress (2018)

Journal Reviewer

- TECS ACM Transactions on Embedded Computing Systems (2019, 2020)
- TDSC IEEE Transactions on Dependable and Secure Computing (2019)

External Reviewer

- ECRTS Euromicro Conference on Real-Time Systems (2013–2015, 2019)
- EMSOFT ACM International Conference on Embedded Software (2020)
- EuroSys European Conference on Computer Systems (2013, 2016, 2019)
- Middleware ACM/IFIP International Middleware Conference (2018)
- RTAS IEEE Real-Time and Embedded Technology and Applications Symposium (2013, 2014, 2016)
- RTNS International Conference on Real-Time Networks and Systems (2014–2016)
- RTSS IEEE Real-Time Systems Symposium (2013, 2016, 2018, 2020)
- SYSTOR ACM International Systems and Storage Conference (2015, 2016)

Teaching Experience

- 2017 **Teaching Assistant, Operating Systems**, MPI-SWS and Saarland University
- 2016 **Teaching Assistant, Distributed Systems**, MPI-SWS and Saarland University
- 2014 **Teaching Assistant, Foundations of Cyber-Physical Systems**, MPI-SWS and TU-KL
- 2010 **Teaching Assistant, Data Structures and Algorithms**, BITS Pilani

Advising

- 2017-2018 **Malte Appel (UdS)**
Undergraduate thesis: *A BFT Key-Value Store for Safety-Critical Distributed Real-Time Systems*
- 2016 **Rohith R (BITS Pilani)**
Summer internship: *An Empirical Evaluation of the Temporal Behavior of Linux's CFS Scheduler*
- 2015 **Akshay Aggarwal (IIT Kanpur)**
Summer internship: *An Analysis of CAN in the Presence of Host and Network Faults*